Final Report for work under the Grant NAGW-3579 for the

Investigations of the Ionosphere and Ionotail of Venus

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The original proposal for this work envisioned a 3-year effort in support of the processing, analysis and publication of measurements made by the Pioneer Venus Orbiter Electron Temperature Probe (OETP). The halving of the Venus Data Analysis Program (VDAP) funding for the second year, and the cancellation of the 3rd year of the program has rather drastically reduced the amount of the proposed work that could be achieved. This Final Report outlines the work that was completed, however, and requests a no cost extension to allow completion of one of the originally proposed tasks. This document outlines the originally proposed work, the accomplishments actually achieved, and remaining work that will be completed using the remaining funds under a no-cost extension.

Objectives and Justification: The original main of the investigation was to use both the entry period measurements and measurements made earlier at solar maximum to define the solar cycle variation of the ionosphere. Additional specific goals were: (1) to cooperate with the ongoing investigations of other VDAP investigators by providing OETP data and interpretation, and (2) to participate in the development of an improved VIRA ionosphere model that will characterize the solar cycle variations of the ionosphere and extend to higher altitudes than the original 1985 model.

Accomplishments: Thus far in the first 6 month of VDAP funding members of the OETP group have published 5 papers based primarily of the OETP measurements. We have also contributed OETP data and authorship on 7 papers authored by other VDAP investigators. These papers are listed below in the Publications listing and reprints are attached.

Remaining Work to be Done Under the No-cost Extension: The remaining task that the existing funds can help support is represented by item (2) above under Objectives; i.e., my participation in the work of improving the VIRA ionosphere model to include solar cycle variations. Arv Kliore, one of the COSPAR VIRA editors has asked me to be lead author on such a paper. A preliminary paper on this topic is the 1994 COSPAR shown in the listing below. The existing funds will support the travel and publications costs associated with the preparation of the paper and to cost of attending the VIRA working group meetings to be held in conjunction with future COSPAR meetings.

Publications: The following is a partial list of our 1993 publications that have arisen in part or in whole from the use of the OETP data under the VDAP program.

"First Analyses of Recent PVO Plasma Analyzer Observations in the Venus Ionotail at Altitudes ~1100 km: Evidence for Ion Acceleration" D. S. Intriligator, L. H. Brace, P. A. Cloutier, W. T. Kasprzak, W. C. Knudsen, and R. J. Strangeway, *Geophys. Res. Lett*, **20**, Dec. 1993.

"Energetics of the Dayside Venus Ionosphere" A. F. Nagy, Zoltan Dobe, L. H. Brace, T.E. Cravens, and J. G. Luhmann, *Geophys. Res. Lett.*, **20**, No. 15, 1523, 1993.

"The Magnetic State of the Lower Ionosphere During Pioneer Venus Entry Phase", C. T. Russell, R. J. Strangeway, J. G. Luhmann, and L. H. Brace, *Geophys. Res. Lett.*, **20**, Dec, 1993.

"Ion Measurements During Pioneer Venus Reentry: Implications for Solar Cycle Variation of Ion Composition and Dynamics, J. Grebowsky, R. E. Hartle, J. Kar, P. A. Cloutier, H. A. Taylor, L. H. Brace, *Geophys. Res. Lett.*, **20**, Dec. 1993.

"Plasma Waves Observed at Low Altitudes in the Tenuous Nightside Ionosphere", R. J. Strangeway, C. T. Russell, C. M. Ho, and L. H. Brace, *Geophys. Res. Lett.*, **20**, Dec. 1993.

"The Nightside Ionosphere of Venus Under Varying Levels of Solar EUV Flux" C. M. Ho, R. J. Strangeway, C. T. Russell, J. G. Luhmann, and L. H. Brace, *Geophys. Res. Lett.*, **20**, Dec. 1993.

"Solar Cycle Variations of Electron Density and Temperature in the Venusian Nightside Ionosphere", Robert F. Theis and Larry H. Brace, *Geopys. Res.Lett* , **20**, Dec. 1993.

"Kilometer-Sized Waves in the Electron Density in the Venusian Nightside Ionosphere", L. H. Brace, *Geophys.Res. Lett*, **20**, Dec. 1993.

"Some Problems with Nightward Ion Flow in the Venusian Ionosphere; Implications for Planetary Ion Escape", L. H. Brace and R. E. Hartle, *EOS*, **74**, No. 43, Oct. 1993. (Fall AGU paper)

"The Ionosphere of Venus Based on Pioneer Venus Measurements", L. H. Brace, *Current Science*, **66**, No. 7&8, 547-549, 1994.

"Evidence for Ion Transport and Molecular Ion Dominance in the Venus Ionosphere", D. S. Intriligator, L. H. Brace, P. A Cloutier, J. M. Grebowsky, R. E. Hartle, W. T. Kasprzak, W. C. Knudsen, R. J. Strangeway, *J. Geophys. Res.*, **99**, 17413-420, 1994.

"An Extension of the VIRA Electron Temperature and Density Models to Include Solar Cycle Variations", L. H. Brace and R. F. Theis, Presented at COSPAR, Hamburg, July 1994 (camera-ready version submitted, in press Adv. Space Sci.).

"The Nightward Ion Flow Scenario at Venus Revisited", L. H. Brace, R. E. Hartle, and R. F. Theis, Presented at COSPAR, Hamburg, July 1994, (camera-ready version submitted, in press Adv. Space Sci.).